Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

1
Ec7Ag
Reserve

Agricultural Economics RESEARCH

FEB 9 1953

CONTENTS FOR JANUARY 1953 *Vol. V, No. 1*

UNITED STATES DEPARTMENT OF AGRICULTURE • Bureau of Agricultural Economics

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. • Price 20 cents

Contributors

Contributors are on the Staff of the Bureau of Agricultural Economics unless otherwise stated

ORIS V. WELLS has been chief of the Bureau of Agricultural Economics since 1946. He entered Government service as Junior Economist in 1929, and since then has been with the Bureau continuously except for 9 months (1931-32) at Harvard for graduate study, and 5 years in the middle 1930's with the Agricultural Adjustment Administration.

HELEN R. WHITE was recently appointed acting head of the Farm Population Section of the Division of Farm Population and Rural Life in BAE. The article of which Mrs. White is co-author was written while she was in the Bureau of the Census, with the Estimates and Forecast Unit, Population and Housing Division.

JACOB S. SIEGEL, chief of the Estimates and Forecasts Unit, Population and Housing Division, Bureau of the Census, also serves as specialist in population estimates and projections in the International Statistics Section of that Division. He and Mrs. White have collaborated in preparing projections of the population of the United States by age and sex, and by States, for the Bureau of the Census.

BEATRICE M. ROSEN is a specialist in current estimates and projections of the population of the United States. She is a statistician in the Estimates and Forecasts Unit of the Population and Housing Division, Bureau of the Census.

EARL E. HOUSEMAN has had a wide variety of experience with survey methods. He is statistical consultant, Office of the Chief of the Bureau.

REX F. DALY, head of the Demand and Price Section of the Division of Statistical and Historical Research, devotes most of his time to appraisals of economic conditions affecting the demand for farm products. He prepares *The Demand and Price Situation*, a monthly report of BAE.

CONRAD TAEUBER is assistant director of the Bureau of the Census. He has taught sociology and statistics and has been secretary of the American Sociological Society.

WAYNE D. RASMUSSEN, a member of the staff of the History Section, Division of Statistical and Historical Research, is acting editor of *Agricultural History*.

EDITORS: CHARLES E. ROGERS
HERMAN M. SOUTHWORTH

AGRICULTURAL ECONOMICS RESEARCH

A Journal of Economic and Statistical Research in the
Bureau of Agricultural Economics and Cooperating Agencies

Volume V JANUARY 1953 Number 1

The Story of Agricultural Economics: A Review

By Oris V. Wells

Ordinarily this article would appear in our Book Review section with the usual citation: The Story of Agricultural Economics in the United States, 1840-1932. *By Henry C. and Anne Dewees Taylor (with foreword by Everett E. Edwards). The Iowa State College Press, Ames, Iowa. XXVI + 1121 pages. 1952. $10. But this is no ordinary book. Rather, if the editors may anticipate their reviewer, this is "a surprisingly good book," one which we think should be called to the attention of all agricultural economists who are interested in the development of their science or discipline. For this is essentially a research product in which the Taylors have traced the development of agricultural economics from its somewhat uncertain beginnings into the year 1932. The plan of the project was based on the idea of quoting the actual words of the agricultural economists themselves rather than simply submitting the ideas of the authors. This task of finding the original sources and making the appropriate selections was a difficult one. In fact, some 200 persons contributed in varying degrees, with the work of collecting materials starting so long ago as 1939 in the form of a joint effort of the senior author, then Managing Director of the Farm Foundation, and the History Section of our Division of Statistical and Historical Research.*

AGRICULTURAL ECONOMICS as a scientific discipline is scarcely 50 years old, yet today agricultural economists are found in considerable profusion everywhere — in the Land-Grant Colleges and most of our leading independent universities, in the numerous agencies of the United States Department of Agriculture, on Congressional staffs, and as advisers or statisticians in many business corporations of one kind or another.

As Everett E. Edwards indicates in the foreword: "Surely the question as to how agricultural economics reached this height in the United States is worth serious study." This book is an effort to answer this question — an effort which started more than a dozen years ago on January 30, 1939, when H. C. Taylor, then Managing Director of the Farm Foundation, wrote to O. C. Stine of the Bureau of Agricultural Economics that he felt it was desirable to begin to get together material relating to the development of agricultural economics in the United States. Stine replied under date of May 24 offering the cooperation of the Agricultural History Section of the Division of Statistical and Historical Research.

The final result of this project is a surprisingly good book — *surprising* in terms of materials used and the way in which they have been brought together, and *good* in that the product is one which it seems to this reviewer at least is sufficiently excellent to well repay Henry C. and Anne Dewees Taylor, and all of their various assistants and collaborators, for the time and effort that went into the work.

Strictly speaking, this is not a story or history of agricultural economics; certainly it is not a story of agricultural economists as such.

Rather, the Taylors set themselves to a major research task. What they have tried to do, and what it seems to me they have done very well indeed, is to analyze the development of ideas over the whole field now covered within the term "agricultural economics," starting with the basic ideas and controversies, some of which trace as far back as 1840. But attention is chiefly centered on the development of agricultural economics into an orderly, scientific discipline within the first third of the current century, during which time the stage was also set for the great proliferation of these same ideas in the applied field after 1932.

As a matter of fact, the Taylors have deliberately chosen to end their analysis with the year 1932 because, as they indicate, "that date marks the dividing line between two eras." To use their own words, what they have sought to do is "to preserve a record of some of the major roots from which agricultural economics has grown, to trace the direction of the growth, and to honor those whose insight, integrity and purposefulness determined both the direction and the soundness of the growth during the years between 1840 and 1932."

Of all the ideas set forth in the book, it is with this one statement as to the dividing line between two eras that this reviewer would be most inclined to argue. But this is beside the point, for again the Taylors recognize that agricultural economics has had and will continue to have continuous growth. And, as the reader works through the several sections of the book itself, he will find that Taylor was keenly aware of the fact that some of the solutions which were being tried during the difficulties of the 1920's were not always satisfactory to farmers and those interested in agriculture; that other solutions were in the process of developing.

Perhaps we should note the opening sentence around which the first sections of the book are built: "The agricultural situation in the 1880's and the 1890's aroused much thought on the part of farmers, congressmen, and economists." In short, it was out of the effort to understand the conditions of agriculture and farm people that agricultural economics developed, and this is the driving force that has maintained the life of the science since Taylor organized the first formal course in agricultural economics at the University of Wisconsin in 1902.

Credits and Method

Something more should be said about the development of the project and the many credits for assistance which the authors acknowledge. As indicated earlier, this study was really started as a joint project between the Farm Foundation and the Bureau. As a part of the first fact-gathering and gaining of perspective, Anne Dewees, at that time employed in the Bureau, was sent in 1939-41 to 16 institutions where research and teaching in the field of agricultural economics was being carried on, interviewing certain key persons, including some outside the colleges, and acquainting herself with the several libraries in which material might be available. Following this, the authors continued to collect materials for another 4 years, at which time the senior author resigned as Managing Director of the Farm Foundation under an arrangement which allowed him to devote full time for the next 4 years to the preparation of the manuscript.

There is no need to list here all the persons who assisted or are given credit, but it does seem worth while to say that the foreword was prepared by Everett E. Edwards, probably representing the last of the many contributions he made to the field of agricultural history before his death in the spring of 1952; that the farm-finance sections were prepared by Norman J. Wall, Head of the Division of Agricultural Finance in the Bureau; and, finally, that those who use this book over the years will on many occasions find themselves indebted to Adelaide R. Hasse for her comprehensive index, which accounts for the last 99 pages of the book. Arrangements had also been made for Leonard A. Salter, Jr., to write the land-economics section, but this was prevented by his untimely death. However, this section does lean very heavily on Salter's thesis, *A Critical Review of Research in Land Economics* (University of Minnesota Press, 1948).

The index is one of the chief keys to the approach the Taylors have used. Perhaps as much as two-thirds of the 1,000-odd pages of the main text is actually devoted to quotations from speeches, correspondence, books, and bulletins

that have to do with agricultural economics. However, this is far more than a book of excerpts or quotations. Still, the Taylors would have rendered a valuable service had they done nothing more than bring this source material together and get it published.

The skill of the authors and the excellence of their attack lie first of all in selection of key materials and, second, in the way in which these are arranged or put together so as to illustrate and analyze the development of ideas. In addition, in their comments and connecting text they have gone some distance in telling the story of the contributors, as well as in giving attention to the manner in which economic materials gradually found their way into use among farmers and increasingly in the policy field.

Organization

The problem as to how to organize the materials was solved by dividing the book into eight main parts, almost any one of which would have represented a substantial contribution. Parts one and two deal with the economic thinking aroused by the agricultural depression of the 1890's and with the early development of rural economics and farm management in the Colleges of Agriculture, carrying the main outline into 1919, when the American Farm Management Association and the Association of Agricultural Economists were consolidated into the single organization, the American Farm Economic Association.

The following six parts in effect divide agricultural economics into six sub-fields and trace and analyze the development and thinking in each of these. The six are: Economic Analysis of Farm Management Problems; Fact Gathering and Agricultural Statistics, including a discussion of the historical and geographical approach, agricultural surveys, cost accounting studies, and the beginning of agricultural outlook work; Marketing Farm Products; Land Economics; Farm Labor and Farm Wages; and Farm Finance.

I am sure that neither the Taylors nor anyone else would argue that the importance of the several sub-fields or the contributions thereto are measured by the proportionate amount of space devoted to them in this book. Yet it is interesting, in view of the current feeling that marketing research has been less emphasized than other fields, that more space is given to the *Marketing of Farm Products* than to any of the other five fields — 287 pages, that is, as compared with 214 pages devoted to the discussion of statistics, fact finding, surveys, and related activities for which it sometimes seems agricultural economists and statisticians are most noted.

What Will Critics Say?

It is interesting to speculate on the criticisms that other reviewers may advance, as well as the answers to these which it seems to this reviewer lie within the text itself. Such possible criticisms include:

(1) *The book is too long, too complex, and in some ways rather difficult to read.*

But had it been the aim of the Taylors to simplify and popularize, it is obvious that they themselves would have chosen quite a different technique. Rather, the aim has been to select and make available the actual texts, drawn from thousands of sources, through which agricultural economics has been developed, and to relate these to one another in such a way as to show not only what ideas have been brought forth from time to time but also which ones have stood the test of time and, even more important, the tests of economic reasoning and scientific research.

As a result, the Taylors have done a definitive job, and it is safe to agree with Everett E. Edwards that anyone interested in writing in this field henceforth will find it literally necessary to start with this book. Here is a guide to the literature of agricultural economics, with a remarkable quantity of information as to the individuals and institutions relating thereto, and with one of the best organized indexes for which one could ask.

As for the argument that the book is complex and in some ways difficult to read, both agricultural economics and life happen to be like that.

(2) *The book is too much devoted to H. C. Taylor and his work.*

Perhaps so; but it seems to this reviewer that after a sober reading of the book one will come to the conclusion that the Taylors have as a matter of fact done an objective job in trying to see

that all worth-while viewpoints are adequately covered. And I am sure the Taylors themselves would be the first to agree that others may supplement their work to advantage.

Considerable space is given to the ideas set forth in Taylor's *An Introduction to the Study of Agricultural Economics*, but this happens not only to have been the first but also for many years the standard American textbook in the field. Also, considerable attention is given to the events that led to the formal organization of the Bureau of Agricultural Economics on July 1, 1922, again a field where Taylor has an intimate and first-hand knowledge inasmuch as he was at the time Head of the Office of Farm Management and did become the first Chief of the new Bureau. Further, Taylor was notably one of the early individuals who insisted that agricultural economics should cover the entire field as we now know it, rather than to be subdivided into several different sciences or disciplines. In short, to use the term fashioned some years ago, Taylor could well lay claim to having been the first "Generalist."

(3) *There are places where the reader may feel that less attention to ideas, with more attention to personalities and controversies, would have made the book more dramatic.*

True. But again this is not what the Taylors set out to do. And as one works through section after section, the advantage of this refusal to be drawn too far into personal controversies becomes apparent. The whole study, after all, is devoted to agricultural economics and, so far as individuals are discussed, the aim, as the Taylors themselves indicate, is to give some recognition and honor to those who contributed to the field.

Concluding Observations

Each reader must of course always evaluate a book for himself. This reviewer has found *The Story of Agricultural Economics* intensely absorbing. It is an outstanding book.

There are many things that one would like to comment upon as, for example, the masterly way in which the Taylors trace the gradual transformation of the early demand for cost accounting studies into what we now know as the budget method of farm-management analysis; the insistence which recurs several times over, and which was one of Taylor's original contributions, as to the differential abilities of individual farmers as farm managers; and, finally, Taylor's clear recognition of the developments which, as he indicates, heralded "the beginning of a change in official thought in Washington on the subject of prices" as early as 1923.

But all this is beside the point. The fact is that this is a book that well covers a vast field of information; a book that will add to the actual current everyday working knowledge of all but a scant handful of agricultural economists, who will, I suspect, actually be the first to read it.

A mimeographed index for volume 4 is now available upon request from

Division of Economic Information
Bureau of Agricultural Economics
U. S. Department of Agriculture
Washington 25, D. C.

Short Cuts in Computing Ratio Projections of Population

By Helen R. White, Jacob S. Siegel, and Beatrice M. Rosen

The increasing interest of agricultural economists and statisticians in regional population trends and projections was noted in the introduction to an earlier article on projections of the regional distribution of the population. This was published in Agricultural Economics Research *in April 1951 (Vol. III, No. 2, p. 41). Many researchers may find, however, that population projections for particular areas in which they are interested are not available, and that all but the roughest methods of projecting population involve somewhat more man-hours of work than can feasibly be expended. The following article presents two short cuts in the projection method described and used in the earlier article – short cuts that simplify the computations and considerably reduce the man-hours required.*

THE METHOD generally known as the ratio method is now often used in developing projections of the population of geographic areas within the United States. An article by Hagood and Siegel presented projections of the population of the major geographic divisions to 1975 *(4)* and a Census Bureau report showed projections for States to 1960 *(9)*. As the method was also recommended or publicized by the International City Managers' Association *(5)*, the Bureau of Foreign and Domestic Commerce *(8)*, and the National Resources Committee *(6)*, it probably is used rather frequently by local estimators. For example, the Schenectady City Planning Commission *(1)*, the California Taxpayers' Association *(2)*, and the Philadelphia City Planning Commission *(7)* used the method to prepare population projections.

Although the ratio method is relatively simple and requires few data, a good deal of time and work is required to apply it if the procedures described by Hagood and Siegel and the report of the Census Bureau are followed, especially if projections for a number of areas and for several decades into the future are desired.

This paper presents two short cuts in applying the particular variation of the ratio method described by Hagood and Siegel and the Census Bureau report. The procedures suggested reduce considerably the time and work required in computing ratio projections of population; they also have other applications in demographic studies and in other fields.

Essentially, the method involves projecting the ratio of the total population of the area for which a projection is desired to the total population of a larger area which contains the first area and for which an acceptable projection of the population is already available. The ratio, or proportion, is projected, in the Census Bureau report and the Hagood-Siegel article, on the basis of two assumptions: (1) That the rate of change in the ratio during the first 12 months of the projection period – that is, the period between the date of the census or of the estimate on which the projections are based, and the date for which a projection is desired – is the same as the average annual rate of change in the ratio for a selected period in the past; and (2) that this rate of change will decrease linearly to zero by some particular future date. If projections are being prepared for all of the subdivisions of the larger area, the projected ratios are adjusted to sum exactly to 1 or 100 percent. The projected ratio or ratios are then applied to the population projection for the larger area to obtain population projections for the smaller areas. For a more detailed discussion of this method, readers are referred to the articles cited.

Two factors keep this procedure from being unqualifiedly simple and brief. First, the derivation of the average annual rate of change in the ratio involves the use of logarithms. Such computations are time-consuming and require technically trained and skilled computers. Second, the procedure requires the computation of both the rate of change in the ratio and the ratio itself for each year of the projection period, even though projections may be desired for only a few particular years. If the populations of 50 areas are to be projected 25 years into the future, 2,500 computations must be made for these

two steps alone. The operations described below eliminate (1) the use of logarithms in computing the average annual rate of change, (2) the computation of the rate of change in the ratio for each year of the projection period, and (3) the computation of the ratio itself for intermediate years.

Approximation of the Average Annual Rate of Change

If we let

r = average annual rate of change in the ratio
R_a = ratio at the start of the base period
R_b = ratio at the end of the base period
t = number of years in the base period,

then the exact value of the average annual rate of change is computed according to the formula:

$$(1+r)^t = \frac{R_b}{R_a}$$

The use of this formula can be illustrated with figures for the West North Central division, as given by Hagood and Siegel in their article. The base period that they selected for computing the average annual rate of change in the ratio for this area is 1890-1950, and the values of R_a, R_b, and t are

$$R_a = 14.19$$
$$R_b = 9.33$$
$$t = 60$$

Hence,

$$(1+r)^{60} = \frac{9.33}{14.19} = 0.6575$$
$$60 \log (1+r) = \log 0.6575$$
$$\log (1+r) = \frac{9.8178958 - 10}{60}$$
$$= \frac{599.8178958 - 600}{60}$$
$$= 9.9969649 - 10$$
$$r = -0.00696 \text{ or } -0.696 \text{ percent}$$

Using the same symbols as those given previously but designating $\frac{R_b}{R_a}$ as y for brevity, we can write the equation for the average annual rate of change

$$(1+r)^t = \frac{R_b}{R_a}$$

in the form

$$r = \sqrt[t]{y} - 1$$

The right-hand side of this equation can be expanded in an infinite series as follows:

$$r = \frac{1}{t}(y-1) + \frac{\frac{1}{t}\left(\frac{1}{t}-1\right)}{2!}(y-1)^2 + \frac{\frac{1}{t}\left(\frac{1}{t}-1\right)\left(\frac{1}{t}-2\right)}{3!}(y-1)^3 + \cdots$$

The first term of this series, designated here as r_1,

$$r_1 = \frac{1}{t}(y-1)$$

is a standard approximation for r suggested (with qualifications) in many mathematics texts. This formula is equivalent to the ratio of the annual average amount of change in the proportion to the proportion at the beginning of the base period. It has been used occasionally in demographic analysis as a substitute for the average annual rate of change in population during a period *(3)*. The differences between r_1 and r for selected values of y and t are shown in figure 1. When t or y equals 1, r_1 is equal to r. In general, r_1 is a satisfactory approximation

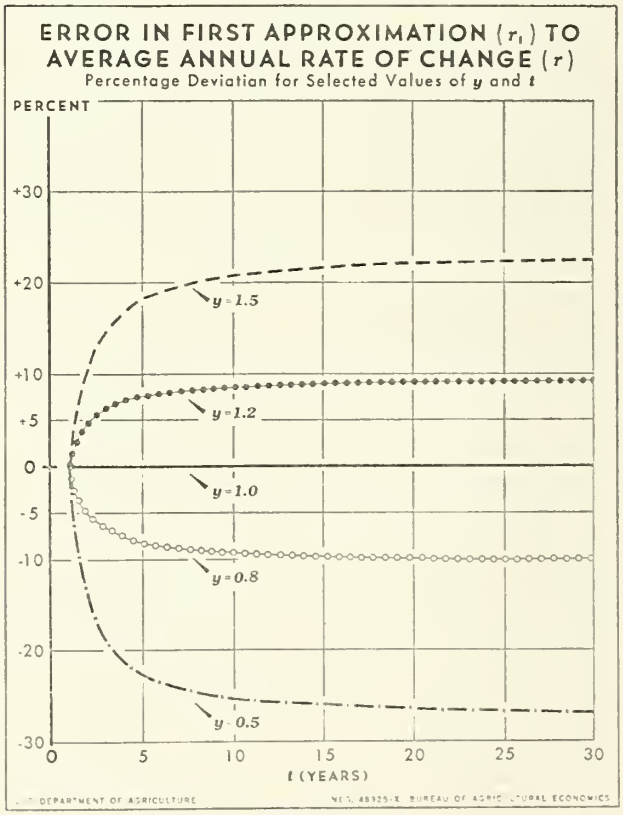

Figure 1

of r (differences of less than 5 percent) only when y falls between 0.9 and 1.1; the difference exceeds 10 percent outside the range $y = 0.8$ and $y = 1.2$ for $t = 5$ years or more. The difference increases with the length of the period and with the deviation of y from 1.0.[1]

The use of terms beyond the first, in the series given above, to compute r would reduce the error but it would add considerably to the work, even though logarithms are not immediately or necessarily involved.

Certain explorations suggested that a good approximation of r, designated here as r_2, could be obtained with comparatively little work from

$$r_2 = \frac{2\,(R_b - R_a)}{t\,(R_b + R_a)}$$

This formula is derived by taking the ratio of the average annual amount of change in the proportion during the base period to the mean of the proportions at the beginning and end of the period:

$$r_2 = \frac{R_b - R_a}{t} \div \frac{R_b + R_a}{2} = \frac{2\,(R_b - R_a)}{t\,(R_b + R_a)}$$

Substituting the figures for the West North Central division, we obtain:

$$r_2 = \frac{2\,(9.33 - 14.19)}{60\,(9.33 + 14.19)} = \frac{2}{60}\,\frac{(-4.86)}{(23.52)}$$

$$= -0.00689 \text{ or } -0.689 \text{ percent}$$

The resulting value of r_2 differs only slightly from the value for r obtained above. In fact, computations over a selected range indicate that r_2 is generally a rather close approximation to r. The differences between r_2 and r, for selected values of y and t, are shown in figure 2. The differences are less than 5 percent when y falls between 0.5 and 1.4 and t falls between 5 and 30. In general, the relative error without regard to sign decreases as the length of the period increases (at least for the range of t tested) and increases as the deviation of y from 1.0 increases. In general also, r_2 is a much better approximation to r than is r_1 (at least for the range of values tested).[2] Only in the special case of $t = 1$ is r_1 a better approximation – a case in which it is simplest to compute r directly; in the special case of $y = 1$, both r_2 and r_1 equal r.

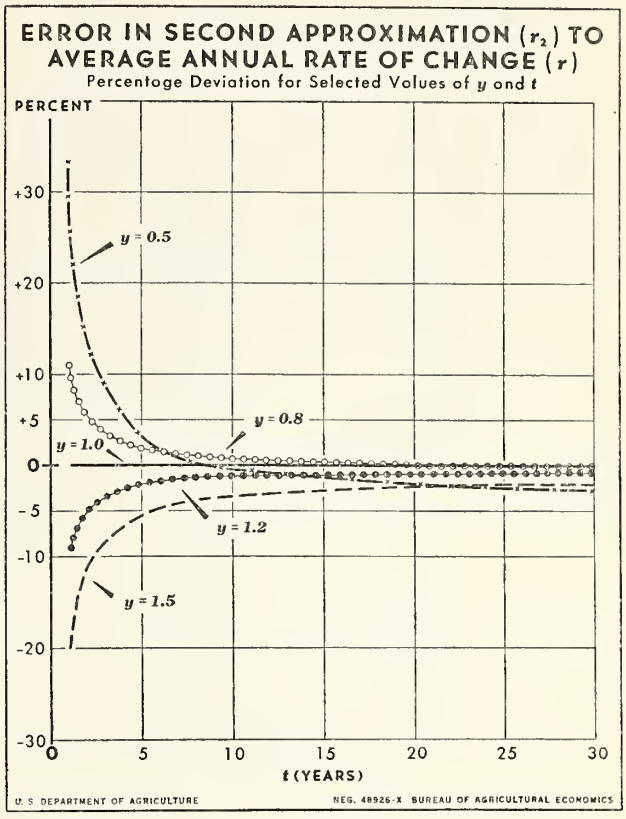

Figure 2

On the basis of the present analysis, r_2 is recommended as a generally satisfactory approximation for the annual average rate of change. It generally involves only a relatively small error, requires only simple operations, and takes little time to compute.[3]

[1] Percentage deviations were computed for values of y from 0.5 to 1.5 at intervals of 0.1 and values of t of 1, 2, 5, 10, 20, and 30.

[2] Test computations indicate that the general pattern of the percentage deviations of r_1 and r_2 from r at $t = 30$, for various values of y from 0.5 to 1.5, as shown in figures 1 and 2, prevails from $t = 30$ to at least $t = 80$.

[3] Herman M. Southworth has suggested an additional formula:

$$r_3 = \frac{R_b - R_a}{t\,R_c}$$

where R_c is the ratio at the midpoint of the base period. Glenn L. Burrows has shown that, for r positive, r_3 would ordinarily be a better approximation to r than r_2; and for r negative, r_2 would be the better approximation to r.

It should be noted that R_c is not always known and that even in the range in which r_3 yields closer approximations than r_2, r_2 may still be a satisfactory approximation (see curves for $y = 1.5$ and 1.2 in figure 2).

Short Cut in the Application of the Average Annual Rate of Change

According to the assumptions used by Hagood and Siegel and by the Bureau of the Census, the annual rate of change in the proportion for a particular area would be reduced linearly to zero by a given future date. If we let

R_o = ratio at the start of the projection period (R_o may coincide with R_b, the ratio at the end of the base period)

R_i = ratio in the i^{th} year of the projection period

n = number of years between the start of the projection period and the date by which the ratio becomes constant,

then

$$R_1 = R_0\ (1 + r)$$

$$R_2 = R_0\ (1 + r)\ (1 + \frac{n-1}{n} r)$$

$$R_3 = R_0\ (1 + r)\ (1 + \frac{n-1}{n} r)\ (1 + \frac{n-2}{n} r)$$

$$R_i = R_0\ (1 + r)\ (1 + \frac{n-1}{n} r)\ (1 + \frac{n-2}{n} r)$$

$$\ldots\ (1 + \frac{n-i+1}{n} r)$$

Usually the annual reduction in the rate of change is first computed and then added to, or subtracted from, the initial rate of change serially to get the successive factors in the formula. For the West North Central division, the ratios for 1951, 1952, and 1953, assuming $n = 25$, are obtained as follows:

$$\frac{r}{n} = \frac{-0.00696}{25} = -0.000278$$

$$R_1 = R_0\ (1 + r) = 9.33\ (1 - 0.00696) = 9.265$$

$$R_2 = R_1\ (1 + r - \frac{r}{n})$$

$$= 9.265\ (1 - 0.00696 + 0.00028) = 9.203$$

$$R_3 = R_2\ (1 + r - \frac{2r}{n})$$

$$= 9.203\ (1 - 0.00696 + 0.00056) = 9.144$$

This chain process is continued until the ratio(s) for the desired year(s) have been computed. The result obtained for 1975 is 8.520. (The final proportion shown in the Hagood-Siegel article – 8.33 – is somewhat different because the projected ratios for all the divisions in the United States were adjusted to sum to 100.00 percent.)

TABLE 1.—*Multipliers (c_{ij}) for projecting a population ratio, assuming that the ratio will become constant in 25 years* [1]

Length of projection period in years (i)	$j = 1$	$j = 2$	$j = 3$	$j = 4$	$j = 5$
1	1.00				
2	1.96	0.9600			
3	2.88	2.7632	0.88		
4	3.76	5.2976	3.31	0.8	
5	4.60	8.4560	7.76	3.6	(2)
6	5.40	12.1360	14.53	9.8	(2)
7	6.16	16.2400	23.75	20.8	10
8	6.88	20.6752	35.45	37.9	30
9	7.56	25.3536	49.50	62.0	50
10	8.20	30.1920	65.73	93.7	90
11	8.80	35.1120	83.85	133.1	150
12	9.36	40.0400	103.51	180.1	220
13	9.88	44.9072	124.33	233.9	320
14	10.36	49.6496	145.89	293.6	430
15	10.80	54.2080	167.73	357.8	560
16	11.20	58.5280	189.41	424.9	700
17	11.56	62.5600	210.48	493.1	850
18	11.88	66.2592	230.50	560.4	1010
19	12.16	69.5856	249.06	625.0	1170
20	12.40	72.5040	265.76	684.7	1320
21	12.60	74.9840	280.26	737.9	1460
22	12.76	77.0000	292.26	782.7	1570
23	12.88	78.5312	301.50	817.8	1670
24	12.96	79.5616	307.78	841.9	1730
25	13.00	80.0800	310.96	854.2	1770

[1] It is assumed that the annual rate of change in the ratio will change linearly. $R_i = R_0\ (1 + c_{i1}\, r + c_{i2}\, r^2 + c_{i3}\, r^3 + c_{i4}\, r^4 + c_{i5}\, r^5)$.

[2] Less than 5.

TABLE 2.—*Multipliers (c_{ij}) for projecting a population ratio, assuming that the ratio will become constant in 50 years*[1]

Length of projection period in years (i)	$j = 1$	$j = 2$	$j = 3$	$j = 4$	$j = 5$
1	1.00				
2	1.98	0.980			
3	2.94	2.881	0.9		
4	3.88	5.644	3.6	1	
5	4.80	9.214	8.8	4	(2)
6	5.70	13.534	17.1	12	(2)
7	6.58	18.550	29.0	27	(2)
8	7.44	24.209	45.0	52	(2)
9	8.28	30.458	65.3	90	100
10	9.10	37.248	90.3	144	200
11	9.90	44.528	120.1	216	300
12	10.68	52.250	154.8	310	400
13	11.44	60.367	194.5	427	700
14	12.18	68.832	239.2	571	1000
15	12.90	77.602	288.8	743	1400
16	13.60	86.632	343.1	946	1900
17	14.28	95.880	402.0	1179	2600
18	14.94	105.305	465.3	1444	3300
19	15.58	114.866	532.7	1742	4300
20	16.20	124.526	603.9	2072	5300
21	16.80	134.246	678.6	2435	6600
22	17.38	143.990	756.5	2828	8000
23	17.94	153.723	837.1	3252	9600
24	18.48	163.410	920.1	3704	11300
25	19.00	173.020	1005.1	4182	13300

[1] It is assumed that the annual rate of change in the ratio will change linearly. $R_i = R_0 (1 + c_{i1} r + c_{i2} r^2 + c_{i3} r^3 + c_{i4} r^4 + c_{i5} r^5)$.

[2] Less than 50.

But such chain computations can be eliminated. It is possible to develop sets of multipliers by means of which the ratios can be computed directly for any desired year — that is, without computing the values of the rates of change or the ratios for the intermediate years. But the step-by-step procedure is still preferable when projections are needed for each year between the base date and some future date.

With the multipliers it is simply necessary (1) to compute the values of the powers of r up to the 4th or 5th power (r, r^2, r^3, r^4, r^5); (2) to take the cumulative product of the powers of r and the appropriate multipliers; and (3) to multiply one plus the result in (2) by the ratio at the beginning of the projection period. Multipliers for the assumption that the annual rate of change will be reduced linearly to zero within 25 years are shown in table 1, and for the assumption that the annual rate of change will be reduced linearly to zero in 50 years are shown in table 2. In these tables, a given row contains the multipliers for a particular length of projection period; within that row, the first column contains the multiplier for r, the second for r^2, and so on.

For an illustration of the procedure for deriving the ratio for the West North Central division for 1975, on the assumption that the ratio will cease changing by that year, see table 3. The projected ratio obtained by the use of the multipliers in this example is (except for rounding) the same as that obtained by the exact and longer procedure.

The results obtained by the use of the multipliers shown in tables 1 and 2 are, however, approximations, in that the multipliers have been rounded and multipliers for powers of r higher than r^5 are neglected. On the other hand, the error involved is negligible. In fact, additional digits can be dropped from the multipliers, and the multipliers for r^4 and r^5 can be disregarded in certain cases, depending on the number of significant figures required in the results. (Note that the use of both r^4 and r^5 does not affect the final rounded result in the illustra-

TABLE 3.—*Illustration of computation of projected ratio, West North Central division, 1975*

Powers of r	Multipliers for 25-year period	Products
$r = -0.00696$	13.00	-0.090480
$r^2 = +0.000048442$	80.08	$+0.003879$
$r^3 = -0.0000003372$	310.96	-0.000105
$r^4 = +0.00000000235$	854.20	$+0.000002$
$r^5 = -0.00000000002$	1770.00	-0.000000
Total		-0.086704

$R_{25} = (R_0)\ (1 + \text{sum products})$
$R_{25} = (9.33)\ (1 - 0.086704)$
$R_{25} = (9.33)\ (0.913296) = 8.521$

tion given above.)

The multipliers are derived as follows:

It may be recalled that

$$R_i = R_0\ (1+r)\ (1+\frac{n-1}{n}r)\ (1+\frac{n-2}{n}r) \ldots . (1+\frac{n-i+1}{n}r)$$

When the indicated multiplications are carried out, all terms involving a specific power of r, represented by r^j (j takes on values from 1 to i), can be collected into a single term, $c_{ij}r^j$; that is, R_i can be represented by the power series

$$R_i = R_0\ (1 + c_{i1}\,r + c_{i2}\,r^2 + c_{i3}\,r^3 + \ldots . + c_{ii}\,r^i)$$

It is convenient to refer to the coefficients, c_{ij}, for all r^j's in the power series of all R_i's, in matrix notation. These coefficients can then be denoted by a matrix, C_{ij}, where, as before, i corresponds to the number of years between the base date and the date for which a projection is desired, and j corresponds to the power to which r is raised. Table 1 is a portion of the matrix for $n = 25$ and table 2 is a portion of the matrix for $n = 50$.

The matrix is formed as follows:

(1) All the elements above the main diagonal are zero.

(2) $c_{11} = 1$

(3) $c_{i1} = \dfrac{nc_{(i-1)1} + (n-i+1)}{n}$

(4) For all other elements

$$c_{ij} = \frac{nic_{(i-1)j} + n^{j-1}\,(n-i+1)\,c_{(i-1)\ (j-1)}}{n^j}$$

The various coefficients may be evaluated successively from one another by beginning with c_{11}, c_{21}, and c_{22}. For example, the element c_{82}, for $n = 25$, may be evaluated from equation (4) given above and the data in table 1 as follows:

$$c_{82} = \frac{25^2\,c_{72} + 25\ (25-8+1)\,c_{71}}{25^2}$$

$$c_{82} = \frac{625\ (16.24) + 25\ (18)\ (6.16)}{625}$$

$$c_{82} = 20.6752$$

Similar multipliers could be developed on the basis of other assumptions as to the date by which the annual rate of change will be reduced to zero. Multipliers could be developed also on the assumption that the rate of change will equal, at a particular future date, a specified proportion of its size at the base date; for example, that the rate of change will be cut in half by 1975. Similarly, particular values of r other than zero could be assigned for the future date. Multipliers could also be developed for other types of curves (beside a straight line) describing the future trend of the annual rate of change. Once the multipliers are worked out, they may be used again and again to derive the final values of the proportions for the dates desired without computing the intermediate values in chain fashion. Under the particular assumption that the annual rate of change will remain constant, it is possible, of course, to compute the final estimate of the proportion directly, without multipliers, according to the formula

$$R'_i = R_0\left(\sqrt[t]{\frac{R_b}{R_a}}\right)^i$$

where

$$\sqrt[t]{\frac{R_b}{R_a}} - 1 = r$$

the exact value of the average annual rate of change.

Literature Cited

(1) BARTHOLOMEW, HARLAND, and ASSOCIATES.
1948. THE COMPREHENSIVE CITY PLAN FOR SCHENECTADY. New York City Planning Commission.

(2) BROWN, HUGH H.
1950. WHAT ABOUT 1960? AND A. D. 2000? Calif. Taxpayers' Assoc. The Tax Digest. 28(10): 336-338, 350-353.

(3) Dunn, Halbert L., Eldridge, Hope Tisdale, and Powell, Nora P.
1945. DEMOGRAPHIC STATUS OF SOUTH AMERICA. Amer. Acad. Polit. and Social Sci. Ann. 237: 22-33.

(4) Hagood, Margaret Jarman, and Siegel, Jacob S.
1951. PROJECTIONS OF THE REGIONAL DISTRIBUTION OF THE POPULATION OF THE UNITED STATES TO 1975. U. S. Bur. Agr. Econ. Agr. Econ. Research, 3(2): 41-52.

(5) International City Managers' Association.
1948. LOCAL PLANNING ADMINISTRATION. Ed. 2, 337 pp., Chicago. p. 70.

(6) Lorimer, Frank.
1938. SUGGESTED PROCEDURES FOR POPULATION STUDIES BY STATE PLANNING BOARDS. Washington, D. C., U. S. National Resources Committee. pp. 70-80.

(7) Philadelphia City Planning Commission.
1948. ESTIMATES OF FUTURE LONG-TERM TREND OF POPULATION GROWTH IN PHILADELPHIA—CAMDEN INDUSTRIAL AREA, 1950-2000. Phil. City Planning Comm. Planning Study No. 1, 20 pp.

(8) Roterus, Victor, and Schmitt, Robert C.
1951. SHORT-RANGE FORECASTING FOR MUNICIPAL PURPOSES. U. S. Bur. Foreign and Dom. Com. Business Information Service. pp. 4 and 5.

(9) White, Helen R., and Siegel, Jacob S.
1952. PROJECTIONS OF THE POPULATION BY STATES: 1955 AND 1960. U. S. Bur. Census. Current Population Reports, Series P-25, No. 56.

Lewis Cecil Gray

Dr. L. C. Gray, aged 70, former assistant chief of the Bureau of Agricultural Economics, land economist, historian, public administrator, and distinguished leader in agricultural economic thought and action, died at his home near Raleigh, N. C., November 18.

Dr. Gray came to the Department of Agriculture in 1919 as the first chief of the Division of Land Economics in the old Office of Farm Management and Farm Economics. When BAE was established in 1922 his division was merged with the new Bureau. In the 1930's, still carrying the responsibilities of his division, he served successively as chief of the Land Policy Section of the Agricultural Adjustment Administration and assistant administrator of the Resettlement Administration in charge of the Land Utilization Division. He was appointed assistant chief of BAE in 1937 and retired for disability in 1941.

Before joining the staff of the Department of Agriculture, Dr. Gray taught agricultural economics at a number of universities, including the University of Wisconsin, where he studied with R. T. Ely, H. C. Taylor, and J. R. Commons, educators whose influence was instrumental in guiding and shaping his career. He was the author of *Introduction to Agricultural Economics,* pioneer text in its field, and *History of Agriculture in Southern United States to 1860,* a 2-volume work of lasting historical significance. He served as president of the American Farm Economic Association in 1928 and as a member of the United States delegation to the International Institute of Agriculture in 1922 and 1928. He was a member of many national and international study groups and committees, including the President's Great Plains Committee and the President's Committee on Farm Tenancy.

Statistical Treatment of the Nonresponse Problem

By Earl E. Houseman

Given a sample—that is, a specified selection of individuals from whom specified information is desired—two questions immediately arise: How much effort should be spent toward getting complete coverage of all individuals in the sample? What methods can be used to adjust for nonresponse, and how successful are such methods? Although only partial answers to the nonresponse problem can be given, this review of techniques and the presentation of a few concepts and results relating to the nonresponse problem should be helpful, particularly to persons who are planning surveys.

IN PRACTICE, the rates of response (percentage of the individuals specified for the sample for whom questionnaires are obtained) vary from as low as 5 percent or less to 100 percent. Response rates of 5 percent or less have occurred in some cases where a mailed questionnaire was used and only one mailing was made and none of the nonrespondents were interviewed, whereas in other cases a response exceeding 80 percent has been obtained from a mailed questionnaire. For interview surveys the rates of response are often less than 90 percent and in some areas they are sometimes as low as 30 to 40 percent if only one call was made at each sample household. To get a rate of response of 90 percent or more usually requires considerable effort.

The response pattern for a Nation-wide interview survey of consumer preferences for citrus products is shown in table 1. In general, the proportion of questionnaires completed on first call, second call, etc. will vary from survey to survey depending upon the time of year, the time of day the calls are made, the ingenuity of the field staff in making the second or later calls successfully, and other factors. But the pattern displayed in table 1 is rather typical. In this survey as many as eight or nine calls were made on some households in the cities and metropolitan areas, whereas in the open country not more than three calls were made at one household. But interviews were obtained with only 83 percent of the sample households in metropolitan areas compared with 91 percent in the open country. The refusal rate in this survey was somewhat higher than the average (2 to 3 percent for most similar surveys) which the Bureau of Agricultural Economics has experienced.

Failure to obtain close to a 100-percent response is not serious unless the respondents differ appreciably from the nonrespondents; in general, they do differ, though sometimes by only a negligible amount. However, it is the writer's belief that bias due to nonresponse is of sufficient general occurrence so that plans to insure a high rate of response (in general about 90 percent or more), or a satisfactory means for adjusting for possible nonresponse bias, should be part of the specifications for any survey, unless past experience with the particular type of survey has demonstrated that such precautions are not needed. Even then, one should be constantly on guard to detect such biases.

Although the nonresponse bias differs from one situation or time to another, a few general patterns commonly appear. With the mailed questionnaire there is usually an "interest" bias that might be revealed in various ways—for instance, through familiarity with the subject, or having the item under study. Nonresponse bias in interview surveys is associated with the factors that are associated with the likelihood of finding a qualified person at home. These factors include family size, edueation, age, and employment status. In general, there appears to be some tendency for nonresponse bias to be greater for personal characteristics of the individual than for characteristics, for example, of his farm or dwelling.

Definition of Bias Due to Nonresponse

Consider a population of N individuals and a specified system of field operations for contacting a random sample of members of a population. Let p_i, where

$$0 \leq p_i \leq 1 \qquad (1)$$

represent the probability of obtaining a questionnaire from the ith individual in the population, assuming the ith individual has been se-

TABLE 1.—*Number of interviews by call and nonresponse for a national consumer preference survey* [1]

Item	Area								Total	
	Metropolitan [2]		Cities [3]		Towns [4]		Open country			
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Interviews obtained on										
1st call	446	36	593	41	562	50	504	68	2,105	46
2d call	273	22	378	26	275	25	139	19	1,065	24
3d call	186	15	185	13	97	9	29	4	497	11
4 or more calls	118	10	118	8	54	5			290	6
Not at home	99	8	79	6	77	7	47	6	302	7
Refusals	82	7	62	4	21	2	11	1	176	4
Other	28	2	35	2	26	2	14	2	103	2
Total	1,232	100	1,450	100	1,112	100	744	100	4,538	100

[1] This was a national survey of housewives relating to preference for citrus products, conducted by the Bureau of Agricultural Economics during January and February, 1950.
[2] Metropolitan: This stratum is comprised of the 13 largest metropolitan areas, 9 of which were in the sample.
[3] Cities: Places with a population of more than 10,000 in 1940.
[4] Towns: Incorporated and unincorporated places up to 10,000 population in 1940.

lected for a sample. The specifications for field operations might, for example, include the requirement that as many as three calls be made, but fourth calls should not be made. In this case, p_i is the probability, assuming that the ith individual is in the sample, that he will be contacted on three or fewer calls, and if contacted will cooperate. The p_i for everyone who would refuse is zero. Likewise, p_i would be zero in the situation in which the field work is restricted, for example, the hours 9:00 a.m. to 5:00 p.m. and the ith individual is never home during those hours. Hence, it is clear that a different set of p_i's is postulated for each system of field operations although the system of field work might not be clearly defined.

Suppose that a random sample of k is selected with equal probabilities. The expected response rate, $\bar{p}$, is the average of all p_i's; that is

$$\bar{p} = \frac{1}{N} \sum_{i=1}^{N} p_i$$

Hence the expected number of completed questionnaires is $\bar{p}k$.

Next, let X_i be the value of some item X for the ith individual and let the sample mean of X for the respondents be $\bar{x}_r$.

Thus,
$$\bar{x}_r = \frac{1}{k_r} \sum_{i=1}^{k_r} X_i$$

where k_r is the number of respondents.

The nonresponse bias, b, is now defined as the difference between the expected value of $\bar{x}_r$ and the population mean $\bar{u}$, where

$$\bar{u} = \frac{1}{N} \sum_{i=1}^{N} X_i$$

Hence,
$$b = E(\bar{x}_r) - \bar{u}$$

However, since k_r is a random variable, the expected value of $\bar{x}_r$ involves the expected value of a ratio or an approximation; namely,

$$E(\bar{x}_r) \doteq \bar{u}_r = \frac{\sum_{i=1}^{N} X_i p_i}{\sum_{i=1}^{N} p_i}$$

It is clear that $\bar{u}_r$ is simply a weighted average of X using the p_i's as weights, which gives a conception of the quantity which $\bar{x}_r$ is an estimate of.

Similarly,

$$E(\bar{x}_n) \doteq \bar{u}_n = \frac{\sum_{i=1}^{N} X_i (1-p_i)}{\sum_{i=1}^{N} (1-p_i)}$$

where $\bar{x}_n$ is the unknown average of X for the nonrespondents in the selected sample. As $\bar{u} = \bar{p}\,\bar{u}_r + q\,u_n$, where $\bar{q} = 1-\bar{p}$, the bias b can be written in the form

$$b \doteq \bar{u}_r - \bar{u} = \bar{q}\,(\bar{u}_r - \bar{u}_n) \qquad (2)$$

It may also be useful to consider the size of the bias as a percentage of $\bar{u}$. Thus,

$$B = 100\left[\frac{1}{\bar{p} + \bar{q}d} - 1\right]$$

where $$d = \frac{\bar{u}_n}{\bar{u}_r}$$

The relative response bias is plotted in figure 1, which provides a basis for judging the possible extent of bias due to nonresponse if one has some information on response rates and can make reasonably good guesses as to the relative difference between respondents and nonrespondents. Even with a response rate of 0.95, the nonresponse bias is as much as 5 percent when the value of d is equal to 2.0.

In the preceding discussion, a simple arithmetic average has been assumed as a method of estimation. It is recognized that for other types of estimation the nonresponse bias might be different. In a farm survey, for instance, the sample average number of acres per farm in a given crop might be biased because of nonresponse, whereas the ratio of acres in the particular crop to total acres of cropland might be virtually unbiased.

There is a wide variety of practices and methods of dealing with the nonresponse problem. Some of these methods are discussed here under succeeding headings.

Substitution and Weighting

If no one is at home or the respondent refuses to give information, should a substitute be selected? Should substitution be permitted after the first not-at-home call or only after two or more calls have been made? If substitutions are permitted, how should the substitutes be selected? Such questions are frequently asked. No uniformity of practice is evident except within some agencies.

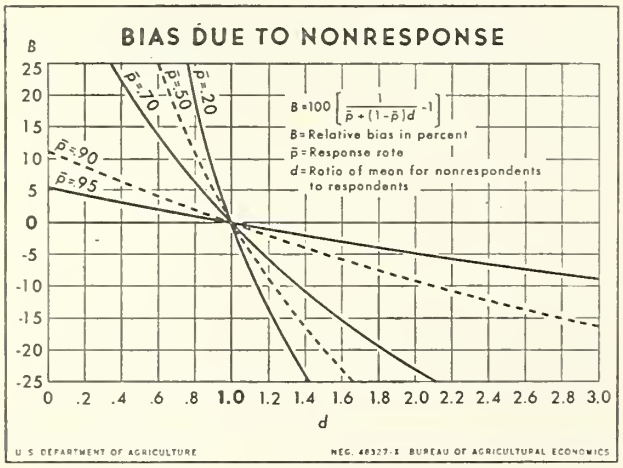

Figure 1

Substitution is deficient as a solution to the nonresponse problem because the substitutes do not constitute, in a statistical sense, a sample of the nonrespondents. In fact, one might expect, as several studies have shown, that the substitutes tend to be more like the respondents than the nonrespondents. But the making of substitutions may have some advantages. The rate of response can vary considerably from one location to another (table 1), including locations within cities or counties. By making substitutions, the areas are represented in the sample in the intended proportions. Following this idea into more detail, elaborate schemes of substitution such as requiring that the substitute match the nonrespondent on one or more characteristics, could be used; but under such a plan considerable effort might be spent finding substitutes. One alternative, if the necessary information is available, is to introduce weighting into the tabulations to allow for differential response by areas or other factors.

With respect to the removal of nonresponse bias, the making of substitutions in the field is about equivalent, in the writer's opinion, to a corresponding weighting of data in the office. Consider cluster sampling, for example. If an interview is unobtainable with one of the households in a sample cluster, the selection by some objective means of a substitute just outside of the cluster appears to the writer about equivalent, in terms of nonresponse bias, to substitution of the cluster average of the completed questionnaires for the missing household. Either alternative removes only a component of nonresponse bias that can be associated with differential response by areas. Similarly, selecting the nearest household outside of the cluster that matches the nonrespondent household with respect to number of persons, for example, might be about equivalent to weighting the data in the office to adjust for differential response by area and size of household. Although in the majority of cases such weighting of data (or

substitution) probably gives some reduction of error, it does not necessarily lead to an improvement—in fact, the error might be increased. There is frequently too much confidence that weighting poor data will give good results.

Analysis of Successive Responses

This section applies to surveys having three or more response waves. With mailed questionnaires this means three or more mailings and classification of the returns by first, second, or third mailing, or perhaps one mailing and classification of the questionnaires by date received. Similarly, for interview surveys the response waves would be defined in terms of the call on which an interview was obtained.

(1) One method of coping with the nonresponse problem is to compute averages or "statistics" for each response wave and then from an inspection of the differences among the waves, to decide subjectively upon an average for the nonresponse group. The estimate is of the form $\bar{x} = p_r\bar{x}_r + p_n\bar{x}_n$ where p_r and p_n are respectively the sample proportions of respondents and nonrespondents, $\bar{x}_r$ is the average for all respondents and $\bar{x}_n$ is an assumed average for the nonrespondents. No matter how the nonresponse problem is treated some assumption is made about the nonresponse group. Making no adjustment for nonrespondents is equivalent to assuming $\bar{x}_r = \bar{x}_n$. Substituting guesses at the smallest and largest values of $\bar{x}_n$ that have any possibility of existing is sometimes helpful in judging the outside limits of the extent of bias due to nonresponse that might exist.

(2) A procedure that has been considered but used very little, if any, is to prepare a chart and visually make an extrapolation. The chart is prepared by plotting on the horizontal axis the accumulated percentage response, and on the vertical axis the corresponding accumulative averages. Thus, the first point has as its abscissa the percentage responding on the first wave and the ordinate is the average for the first wave. The next point is for those responding on the first and second waves combined. The third point would be for those responding on the first, second, and third waves combined, et cetera. The line or trend as established by these points is projected to 100 percent, and the ordinate at 100 percent gives the estimate. The writer has no knowledge of this method having been studied or used. It has the appearance of lacking precision unless the response rate is high.

(3) Hendricks [1] has suggested a more refined approach to the analysis of successive response waves to correct for nonresponse. His approach involves postulating a frequency distribution of resistances to returning the mailed questionnaires, the resistances ranging from zero to infinity. Those responding to the first mailing might be assigned 1 unit of resistance, to the second mailing 2 units of resistance, et cetera. It is assumed that the logarithms of the resistances are normally distributed, which provides a basis for estimating the average resistance of all individuals on the mailing list. An equation is then set up to represent the relationship between the resistance to returning a questionnaire and the item whose average is being estimated. Substitution of the average resistance in this equation gives a result that is the estimate of the population average.

The mathematical form of the models used in this approach need further investigation, and tests using data from several surveys along with good check data are needed to ascertain its utility.

(4) Ferber [2], in 1948, considered the use of tests for random order as a basis for learning the need for follow-ups to mailed questionnaires, the questionnaires being ordered according to the time of the response. This idea is based upon the hypothesis that, if respondents and nonrespondents are alike, the returns would be independent of the time the questionnaires are received. Ferber recognized, however, that nonresponse bias could occur even though the order of receipt was random, and that random order with respect to one question did not assure randomness with respect to another question.

Ford and Zeisel [3] later presented some results that cast considerable doubt on the utility of random order tests to detect nonresponse bias.

[1] Hendricks, W. A. Adjustment for bias caused by non-response. Agricultural Economics Research, 1:52-53, 1949.

[2] Ferber, Robert, the problem of bias in mail surveys: a solution. Public Opinion Quarterly, 12:669-676, 1948.

[3] Ford, Robert N., and Zeisel, Hans. Bias in mail surveys. Public Opinion Quarterly, 13:495-501. 1949.

Their findings showed that differences between early and late responses could not be relied upon to indicate the result for the nonresponse group. Moreover, some examples were cited in which there was a substantial nonresponse bias even though the early and late responses were about the same.

Subsampling of Nonrespondents

In 1946, Hansen and Hurwitz[4] reported a technique for combining some of the advantages of the mailed questionnaire and of personal interviews. The technique avoids bias due to nonresponse and takes advantage of the lower costs of the mailed questionnaire. The procedure requires contacting in person a subsample of the nonrespondents to mailed questionnaires. Every effort is then made to obtain questionnaires for the individuals in the subsample. Compared with interviewing everyone in a sample this technique is most advantageous when the response rate to a mailed questionnaire is high and the difference between the cost of the mailed questionnaire and personal interview is large.

The theory is also applicable to interview surveys. After one or more calls have been made, a subsample of the remaining nonrespondents may be selected and an intense effort made to complete a questionnaire for every member of the subsample.

Determination of the Optimum Number of Call-Backs

The problem of determining the optimum number of call-backs to be made has been attacked mathematically by Birnbaum and Sirken[5] for questions that can be answered as Yes or No, and assuming that only one question is asked. Their procedure was to determine sample size (in terms of number of individuals selected for the sample rather than the number of completed questionnaires) and the number of call-backs that would minimize the expected cost of the survey. This procedure was subject to the conditions that the total error (that is, sampling error plus nonresponse bias) has a probability greater than some specified level of being within a specified range on either side of the population value. To define nonresponse bias, Birnbaum and Sirken assumed that the individuals in the population were either available or not available.

That is, with reference to expression (1), earlier in this discussion, the p_i's were assumed to be either 0 or 1. This gave, however, an expression for the nonresponse bias that was similar to equation (2) ; namely,

$$b = q(p_r - p_n)$$

where q is the percentage of the individuals in the population who are not available, p_r is the percentage of the available individuals in the population who would answer yes, and p_n is the percentage of the nonavailable individuals in the population who would answer yes. To solve the problem it was necessary to make assumptions about the size of the nonresponse bias b. This is an important aspect of the solution, because the value of b can be reduced only by making additional call-backs; and assuming a maximum value of b (to be on the "safe" side) overemphasizes the need for call-backs. The particular results given by Birnbaum and Sirken showed that, up through five calls, each added call-back reduced the expected total cost for specified precision. The constants used in the cost equations were estimated from available data and were thought to be rather typical.

Weighting by the Reciprocals of the p_i's

In 1949, Politz and Simmons developed a plan which was an attempt to obtain unbiased estimates without the necessity of making call-backs.[6] The essentials of this plan can be described by making reference to the earlier discussion on the definition of bias due to nonresponse. It can be shown that, if none of the p_i's are zero, an unbiased estimate of the popu-

[4] Hansen, Morris H., and Hurwitz, William N. The problem of non-response in sample surveys. Amer. Statis. Assoc. Jour. 41:517-528. 1946.

[5] Birnbaum, Z. W., and Sirken, Monroe G. Bias due to non-availability in sampling surveys. Amer. Statis. Assoc. Jour. 45:98-110. 1950.

[6] Politz, Alfred, and Simmons, Willard. An attempt to get 'not at homes' into the sample without callbacks. Amer. Statis. Assoc. Jour. 44:9-31, 1949. This idea was suggested earlier by H. O. Hartley in the discussion of a paper by F. Yates, A review of recent statistical developments in sampling and sampling surveys. Royal Statis. Soc. Jour. Vol. CIX, Part I, 1946.

lation mean, $\bar{u}$, from a random sample of k selected with equal probabilities is

$$\bar{x} = \frac{1}{k} \sum_{i=1}^{k_r} \frac{X_i}{p_i}.$$

Hence, if there is a practical system of field operations and a means of determining the p_i's for the k_r respondents, an unbiased estimate would be possible provided none of the p_i's are zero (or for practical purposes that a negligible proportion of the p_i's are zero). Apparently it is impossible to define a practical system of field operations which, at the same time, would permit a precise determination of the p_i for every individual contacted. Perhaps the best that can be done is to estimate the p_i's.

Politz and Simmons considered dividing the respondents into six groups according to the estimated proportion of time at home during the interviewing hours. The plan was to make only one call at each sample dwelling and to ask each respondent whether or not he was home at six specific times determined at random; hence, the estimated proportions of time at home were in sixths. One of the six was the instance of the interview, which was a random time during interviewing hours. The estimate would then be made by sorting the questionnaires into six groups on the basis of the amount of time at home and weighting each group by the reciprocal of the proportion of the time the respondents in the group were at home. Two important aspects of this plan to keep in mind are:

(1) Although, for practical purposes, this plan might be satisfactory for eliminating nonresponse bias, there could be a residual nonresponse bias remaining if part of the individuals in the population have $p_i = 0$, that is, do not have a chance of being in the sample. Under a call-back plan and a noncall-back plan for which the same individuals have $p_i = 0$, the nonresponse bias should be the same, assuming that call-backs, under the call-back plan, are made to the extent of getting interviews with all persons in the sample other than those with $p_i = 0$. But, in practice it might not be practical to make call-backs to such an extent.

(2) The statistical efficiency of the noncall-back plan needs to be considered, as well as differences in costs, since the loss of statistical efficiency due to weighting can be appreciable.

Costs

One of the missing links in the solution to the call-back problem is information on costs; that is, marginal costs of making call-backs. Some information from two different surveys on cost of call-backs is given below which would indicate that perhaps the cost of call-backs is less than generally presumed. In table 2, the number of interviews as a percentage of number of calls is presented by call number for the national consumer preference survey, discussed earlier. Without any factors tending to make second or later calls successful, one would expect the yield (number of interviews) per call to decrease with each additional call because the households remaining after each call would tend to be home a smaller portion of the time.

TABLE 2.—*Number of interviews by call as a percentage of number of calls*

Area	1st call		2d call		3d call		4th call		5th call	
	Number of calls	Interviews per call	Number of calls	Interviews per call	Number of calls	Interviews per call	Number of calls	Interviews per call	Number of calls	Interviews per call
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Metropolitan	1,232	36	744	37	437	43	199	33	109	26
Cities	1,450	41	823	46	413	45	188	35	96	30
Towns	1,112	50	516	53	186	52	74	53	----	----
Open country	744	68	218	64	46	63	----	----	----	----
Total	4,538	46	2,301	46	1,082	46	461	37	205	34

However, the interviewers on the citrus preference survey were expected to exercise judgment in making calls, after the first, successful by use of such techniques as arranging to make a return visit at a different time of the day or ascertaining from a neighbor when the eligible respondent is likely to be home. They could make appointments but were not instructed to attempt to arrange for appointments generally. This is evidently why in table 2 the yields per call for the second and third calls are as high as for the first. It is likely that ways can be found to further increase the yields per call after the first.

If the yield per call for the first 3 calls is the same, 100 calls would be expected to yield the same number of completed questionnaires under a call-back plan requiring 3 calls, as under a noncall-back plan. In this case the choice between the two is dependent, among other things, upon the difference in statistical efficiency and the difference in the over-all cost per call.

Unfortunately, appropriate costs per interview by call number are not available, and the direction of the differences in cost per interview by call is not obvious, for some of the factors contributing to cost are compensating. For example, the average distance among noncontacted individuals tends to increase with call number. But steps can be taken to increase the likelihood that calls after the first shall be successful. The interviewer can usually locate a house more easily the second time and many of the second or later calls, when they are worked in along with first calls, can be made with the expenditure of little extra time.

On some occasions the Bureau of Agricultural Economics has followed the practice of making as many call-backs as necessary to obtain at least a predetermined rate of response. This principle was applied by county or city, which means that a greater number of call-backs was made in the larger cities or metropolitan areas, for example, than in the open country. This practice not only had the advantage of assuring a minimum over-all rate of response but it also led to a more uniform rate by areas. Space will not permit a discussion of the details of the plan. It worked satisfactorily but might give trouble if the required response rate is too high. In application of the plan, if it was decided that fourth calls, for example, should be made in a particular area, fourth calls were made on all nonrespondent households, not just a part of them. A disadvantage is the difficulty of estimating what the field costs will be.

In 1950, the Statistical Laboratory at Iowa State College conducted a retail-store survey in Iowa. Detailed records of field work were analyzed [7] to estimate costs per interview by call number. This survey, like most others, had several components of field cost which exist regardless of whether call-backs are made. One such component was the cost of moving an itinerant field staff from one assigned county to another. A second was the cost of visiting some stores which turned out to be not eligible for the survey. The eligibility was ascertainable on the first call, irrespective of whether an appropriate person was available to interview. Such costs are appropriately allocated to the cost of first-call interviews.

In table 3, the average cost of collection per interview by call number is given for the retail-store survey in Iowa. It is estimated that, if only one call had been made at each of the sample stores, the cost per schedule would have been $4.12. The estimated additional cost of making second calls is $2.12 per schedule. For the survey as a whole, the average cost was $3.60 per schedule, which is less than the estimated cost per schedule if no call-backs had been made. Incidentally, the rate of response exceeded 99 percent, whereas if no call-backs had been made the rate would have been about 73 percent. The above does not provide sufficient evidence to conclude that a noncall-back plan

TABLE 3.—*Average cost per interview by call for a retail store survey in Iowa*

Call number	Number of interviews	Average cost per interview
1	1,456	$ 4.12
2	417	2.12
3	104	2.36
4, 5, & 6	31	3.19
Total	2,008	$ 3.60

[7] The data were analyzed as part of a cooperative program of research on statistical methods. The results have not been published.

would have been inferior, because $4.12 is not the appropriate estimate of cost for the same number of schedules under a noncall-back plan.

Conclusions

Many articles on the nonresponse problem have appeared in the literature but the problem is far from solved. However, with respect to interview surveys, consideration of available evidence and experience has led the writer to conclude, until such time as further research indicates otherwise, that: (1) A good general practice is to require as many as three calls and ask that fourth calls be made whenever convenient during the course of making other calls. Some variation in the required number of calls could be effected depending upon the nature of the population sampled and the nature of the study. (2) For the purposes of most surveys, a 90-percent response is adequate without attempting to make adjustments for nonresponse, but one should always be on guard for nonresponse biases of appreciable magnitudes. Much depends upon the level of precision required. When high precision is important, perhaps a rate of response of more than 90 percent is requisite.

Book Reviews

Mobilizing Resources for War. By TIBOR SCITOVSKY, EDWARD SHAW, and LORIE TARSHIS. McGraw-Hill Book Company, New York. 284 pages. 1951. $4.50.

Defense, Controls, and Inflation. Edited by AARON DIRECTOR. The University of Chicago Press, Chicago. 342 pages. 1952. $3.50.

War and Defense Economics. By JULES BACKMAN, ANTONIN BASCH, SOLOMON FABRICANT, MARTIN R. GAINSBRUGH, and EMANUEL STEIN. Rinehart & Company, Inc., New York. 458 pages. 1952. $4.50.

AS INDICATED in their titles, each of these books is concerned with mobilizing our resources for war and with the economic problems which arise when a large part of our productive capacity must be diverted to defense production. Apparently most economists and businessmen today are concerned with the problems that may arise as the defense program peaks out and possibly declines in the near future. In fact, several studies of these problems have been published.

Although these three books may appear somewhat outdated, they should not be dismissed as untimely. It is possible that the new studies in process relating to economic policies for the post-defense period may seem equally untimely when they are published. Each represents a contribution to the study of economic aspects of defense mobilization.

Mobilizing Resources for War sets out to present an integrated scheme for mobilizing our resources in a defense economy so as to prevent inflation, inequity, and other excesses that usually accompany a defense build-up. The first essay, written by Lorie Tarshis, sets up models to indicate the nature and approximate extent of strains and tensions that the economy must face if compelled to mobilize its resources for war within a short period. Mr. Tarshis sets up an austere program for civilians, one that leads naturally to his assertion that the main task of policy "... would be to dam back a flood of spending power ..." generated by the high level of economic activity. High taxes alone, according to Mr. Tarshis, would not effect an equitable distribution of goods; and restraints on consumption directed at a fair distribution of goods might bring about an extremely unequal dis-

tribution of savings. Thus mobilization policy, as this writer sees it, must make use of many weapons.

The second part of the book, written by Tibor Scitovsky, appraises the pros and cons of the so-called "disequilibrium system" of control, which is characterized by rather comprehensive direct administrative regulations and which usually results in aggregate money demand substantially in excess of the available supply of goods and services. This system is compared with the proposed "pay-as-you-go" system. Although the author apparently leans toward the latter, he sees a need for some direct controls and is dubious about the administrative feasibility of enforcing the severe tax program required under the pay-as-you-go system. Consequently both plans are rejected.

Having outlined the nature and magnitude of the problems of a defense economy and appraised various alternative programs, a proposed system of controls is outlined in Part III. This section was prepared by Edward Shaw. The proposed program is designed to prevent price inflation, to provide economic incentives, and to be capable of enforcement. At the risk of oversimplifying their rather detailed program, the major proposals might be summarized as (a) rationing of consumer expenditure to restrain consumer spending directly, (b) taxation to drain away as much of the margin between personal income and rationed expenditure as incentive considerations permit, and (c) programs to divert most of the remaining margin of savings into illiquid securities. The proposed control techniques are not new but the authors have presented them in an integrated program that is worthy of study.

Defense, Controls, and Inflation is based on a conference held in April 1951. The list of some 70 participants is an imposing one, including, as it does, representatives of universities, business, research organizations, and the Government. A wide range of opinion was represented in the conference, but apparently there was fairly general agreement on several proposals. The participants seemed to agree on the need for some type of Governmental action, on increased taxes and a substantially balanced budget, and on opposition to an easy-money policy and rigorous maintenance of interest rates. There were, of course, many areas of disagreement and degrees of difference in opinion regarding the type of controls needed. Possibly the major area of dispute centered around "direct" versus "indirect" control. It is doubtful that this controversy was settled to the satisfaction of anyone. However, as usual in a conference of this kind, possibly some participants changed their ideas about controls, and undoubtedly many viewpoints were modified. Though no integrated program is developed in this book, it should be a must on the reading list of anyone who is interested in public policy and controls in a period of defense mobilization.

War and Defense Economics deals comprehensively with production, demand, prices and inflation, economic controls, labor and wage policy, and similar problems in an armament economy. The book was designed to present and appraise past programs as a framework of reference for problems of defense mobilization. It is not a history, but illustrations are drawn liberally from experience in World Wars I and II. The first part deals with potential total production, strategic material supplies, food production, and manpower resources in time of war. Remaining sections set up the nature of armament inflation and discuss in considerable detail fiscal policy, taxation, credit controls, monetary policy, direct price controls, subsidies, and consumer rationing. Although the book has several authors, the development is well integrated. It would be useful in a course in economic problems or as a framework of reference for teachers and students of the economics of war and defense.

Rex F. Daly

Statistics for Sociologists. MARGARET JARMAN HAGOOD and DANIEL O. PRICE. Henry Holt and Company, New York. 575 pages. 1952 (Rev.) $5.75

IT IS A REFLECTION of the rapid development of statistical methods in the social sciences that Margaret Hagood's text, *Statistics for Sociologists,* has had to undergo an extensive revision within 10 years after it was first published. The original edition has been widely used in college courses and the revision should enjoy equal popularity. This text is designed primarily for the first year of statistics for students in sociology. The emphasis is essentially nonmathematical. The basic statistical methods which are used in sociological research are included, along with some of the newer ones which have not yet found wide application. Throughout, the treatment emphasizes the logic of the procedures under discussion and attempts to give the student an appreciation of the nature of statistical data and acquaint him with the advantages and limitations of statistical methods as applied to the data of Sociology.

This emphasis is effectively stated at the beginning of Part IV, which deals with the statistics of relationship: "One should recognize the imperfections of the data, face them, strive to overcome them wherever possible, or attempt to construct tools that will be more appropriate; but in the absence of perfectly fitting tools and situations one should use whatever tools come nearest to fitting the situation and all the information they can divulge with the constant checking of results obtained by comparison with results obtained by other methods."

A student who masters this book will have been introduced to the concepts and techniques in description of statistical data, and he will also have been given a thorough treatment of statistics of relationship, including contingency, analyses of variance and co-variance, correlation, regression, as well as the use of factor analysis in sociological research. None of these are presented as procedures to be applied blindly, but they are rather set out in the framework of alternative methods to be used as applicable in an effort to arrive at statistically sound conclusions. The materials are presented in relation to current or recent sociological research projects.

One feature of the book is its use of problems to illustrate procedures; many of them relate to the same basic set of data. The authors have successfully avoided leading the student astray with such classical materials as the red and black balls in an urn which have left generations of students wondering what conceivable application this had to the actual problems of selecting a sample for a research project in the social sciences.

The present reviewer misses an adequate treatment of the bias and errors that are frequently encountered in the collection of the raw data. Although there is some mention of the problems in this area, the major effort is to give the student the tools with which to process data once they have been collected.

Persons familiar with the earlier edition will miss the section of demographic methods which has been omitted in the present edition. This subject is to be covered in another text, which is scheduled for early publication.

Conrad Taeuber

An Agricultural History of the Genesee Valley, 1790-1860. By NEIL ADAMS MCNALL. University of Pennsylvania Press, Philadelphia. 1952. 276 pages. $5.00.

THE AMERICAN HISTORICAL ASSOCIATION has each year for the last several years sponsored the publication of outstanding manuscripts on American history submitted to its Albert J. Beveridge Memorial Fund Committee. Mr. McNall's study was one of two selected by the Committee in 1949.

The Genesee Valley of western New York, during the 60 years covered by this volume, was transformed from a wilderness into an area of

stable agricultural activities. Its stability has been maintained in large degree to the present time. This history, covering as it does a limited region, is of greatest interest to the nonspecialized economist or historian, not because of the importance of the Genesee Valley as an agricultural area, but because its transformation "recapitulated the development of farming in much of the northern United States."

Settlers moved into the Genesee Valley because of pressures of increasing population in regions to the east upon limited agricultural resources. Once in the valley the settlers found that most of the land was owned by speculators and most prospective farmers had to buy land under contract or become tenant farmers. As the years passed, contracts were paid off but in many cases at the cost of a mortgage on the farm. Few tenants ever achieved ownership, at least in this area, and many farms that were leased in 1860 are still being leased today.

Most early settlers avoided the large natural openings in the forest and the open flats along the river. Once the farmer was on the land, clearing and the provision of a dwelling were of prime concern. Standards of living in this frontier environment were on a subsistence level. Markets—except for potash, livestock, and limited quantities of wheat, wool, and lumber—awaited the development of transportation systems.

The opening of the Erie Canal in 1825 and the establishment of the first rail connections in 1841 made commercial farming possible in the Genesee Valley. More land was cleared and its price rose. A large part of the cleared land was put into the great cash crop of the era, wheat. Much of the wheat left the valley as flour after the development of Rochester as a milling center. Livestock, particularly beef, was the major rival of wheat during the 1830's and 1840's. Within a short time, however, both wheat and livestock decreased in importance under the impact of Western competition. By 1860, wheat had been replaced on many farms by dairy cattle, hay, corn, and other feed grains, market gardens, nurseries, and orchards.

One result of stability was a rise in the standard of living. At the same time the Genesee country could not provide farms for its young people and in consequence many turned to the West or to the cities. Such was the story of the Genesee Valley and such has been the story of many another area of our country.

Wayne D. Rasmussen

Selected Recent Research Publications in Agricultural Economics Issued by the Bureau of Agricultural Economics and Cooperatively by the State Colleges[1]

ABEL, HAROLD, and BROADBENT, DEE A. TRADE IN WESTERN LIVESTOCK AT AUCTIONS. 1. DEVELOPMENT, RELATIVE IMPORTANCE, AND OPERATIONS. Utah Agr. Expt. Sta. Bul. 352, 128 pp. illus. May 1952. (RMA; Agr. Expt. Stas. of Western States and USDA cooperating.)

Apparently the auction method of marketing is likely to continue for some time as an integral part of the western livestock marketing system, although it is probable that many of the longer-run changes in marketing cannot now be foreseen.

ALLEGER, DANIEL E. RENTAL ARRANGEMENTS ON CROP-SHARE FARMS. AN ANALYSIS OF CONTRIBUTIONS AND RETURNS. Fla. Agr. Expt. Sta. Bul. 498, 43 pp. June 1952. (RMA; BAE and Southeast Regional Land Tenure Com. cooperating.)

The 50-50 sharing agreement, the usual crop-share arrangement in the general farming area of Florida, tended to be fair to the cropper and tenant, when net incomes were more than enough to pay all operating ex-expenses, including the value of family labor. This conclusion, however, applied to single-year operations only.

ANDERSON, ROICE H. MARKETING OF CHICKENS FROM PRODUCER TO FIRST HANDLER, WASHINGTON, OREGON, AND UTAH, 1948-49. Utah Agr.

[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

Expt. Sta. Bul. 354, 38 pp., illus. June 1952. (RMA; BAE and PMA cooperating.)

The study reported in this bulletin was based on an analysis of 370 schedules obtained from chicken producers in the three States. Objectives were to describe the enterprise organization of chicken producers and their marketing practices as a basis of determining the degree of competition in the pricing of chickens at the farm level. Cull layers sold for meat accounted for almost half of the chicken meat produced. Prices received varied inversely with the number sold. The level of competition among buyers was relatively low.

BAILEY, WARREN R. ECONOMICS OF SUGAR-BEET MECHANIZATION IN CALIFORNIA. U. S. Dept. Agr. Cir. 907, 48 pp., illus. August 1952.

Eventual complete mechanization could change the entire competitive relationship between sugar beets and other crops, in areas in which production of beets is concentrated and where beets are only a minor crop. But economies resulting from mechanization may be too small to shift the competitive balance in favor of beets.

BOTTS, RALPH R. VARIABILITY OF COTTON YIELDS, BY COUNTIES, IN THE UNITED STATES. 34 pp. Bur. Agr. Econ. August 1952. (Processed.)

Greatest relative variability in county yields has occurred in Texas and Oklahoma. In general, variability decreases from west to east.

BOYD, VIRLYN A. RENTAL ARRANGEMENTS ON TRACTOR AND NON-TRACTOR FARMS IN THE SOUTHERN PIEDMONT. S. C. (Clemson) Agr. Expt. Sta. Bul. 21, 30 pp., illus. January 1952. (RMA; Southeast Regional Land Tenure Com. Pub. 6.)

Results of the study indicate that mechanization is related both to size and type of farm. More of the larger farms had tractors. A smaller proportion of cotton farms than those of other types had tractors.

BURROWS, GLENN L., and BRANT, A. W. MEASURING CHANGES IN QUALITY WHEN QUALITY STANDARDS ARE SUBJECT TO ERRORS IN INTERPRETATION. 11 pp., illus. Bur. Agr. Econ. September 1952. (RMA)

A technique developed to make it possible to detect changes in quality of eggs resulting from repeated candling.

CALHOUN, WENDELL, and CREEK, C. RICHARD. CONSUMER DEMAND FOR RIPENESS OF PEACHES, 1950-1951. Colo. Agr. Expt. Sta. Tech. Bul. 48, 24 pp., illus. June 1952. (RMA; BAE and PMA cooperating.)

In 1948, consumer preference for ripeness of peaches was studied in three markets with fruit sorted at shipping point. In 1949, tests were made in four midwestern cities. A marked preference was indicated for ripe peaches over soft, firm-ripe, or firm.

DAVIS, G. B., and MARTIN, L. C. PACKAGING LATE CROP POTATOES AT SHIPPING POINT AND AT TERMINAL MARKET. Oreg. Agr. Expt. Sta. Bul. 527, 19 pp., illus. October 1952. (RMA)

Results of the study showed that neither the shipping point packer nor the terminal-market repacker had advantages sufficient to exclude the other from packing and marketing consumer-sized units of potatoes.

DUCOFF, LOUIS J., and BIRCH, ELEANOR M. THE HIRED FARM WORKING FORCE OF 1951 WITH SPECIAL INFORMATION ON REGULAR WORKERS IN 1950. 18 pp. Bur. Agr. Econ. October 1952. (Processed.)

In 1951, an estimated 2,156,000 persons worked for farm wages 25 days or more. This was 14 percent less than the number in 1949 and is one of the lowest estimates for this group observed since the end of World War II. The average cash wage income for these farm workers was $879. This amount included $196 from nonfarm wages.

FOOTE, RICHARD J., KLEIN, JOHN W., and CLOUGH, MALCOLM. THE DEMAND AND PRICE STRUCTURE FOR CORN AND TOTAL FEED CONCENTRATES. U. S. Dept. Agr. Tech. Bul. 1061, 79 pp., illus. October 1952. (RMA).

This bulletin discusses the principal economic forces that affect the price and consumption of corn and of total feed concentrates. Because prices of corn are closely related to prices of many other important feeds, it is difficult to separate the demand for corn from that for total feeds by statistical analysis. The major economic forces within the entire feed-livestock economy are discussed, particularly as they relate to the consumption and price of feeds. Detailed studies of seasonal, grade, and locational differentials for the price of corn are included.

FOOTE, R. J., and FOX, KARL A. SEASONAL VARIATION: METHODS OF MEASUREMENT AND TESTS OF SIGNIFICANCE. U. S. Dept. Agr. Agr. Handbook 48, 16 pp. September 1952.

Contains a recommended method of measuring and eliminating seasonal variation from economic data; a moving index of linearly changing seasonal variation; a test of significance; standard errors of indices for individual months and of the difference between successive months; and general comments regarding seasonal variation.

FRENCH, B. C. EFFICIENCY IN FRUIT MARKETING. PACKING COSTS FOR CALIFORNIA APPLES AND PEARS. Calif. Agr. Expt. Sta. Mimeog. Rept. 138, illus. Berkeley. October 1952. (RMA; Giannini Foundation of Agricultural Economics and BAE cooperating.) (Processed.)

The fourth in a series aimed at improved efficiency and lowered costs in local marketing and packing of deciduous fruits.

FREY, JOHN C. SOME OBSTACLES TO SOIL EROSION CONTROL IN WESTERN IOWA. Iowa Agr. Expt. Sta. Research Bul. 391, pp. 945-1007, illus. October 1952. (BAE cooperating.)

According to the findings of the study, the four major obstacles to erosion control were: (1) Change in farm enterprises on 40 percent of the farms; (2) rental arrangement and the landlord's cooperation on 34 percent of the farms; (3) mortgage indebtedness and the annual fixed cash outlays for operating and living expenses on 30 percent of the farms; and (4) short expectancy of tenure on 19 percent of the farms.

GARLOCK, F. L., TOSTLEBE, A. S., JONES, L. A., and BIERMAN, R. W., under the direction of NORMAN J. WALL. THE BALANCE SHEET OF AGRICULTURE—1952. U. S. Dept. Agr. Agr. Inform. Bul. 90, 35 pp., illus. July 1952.

This is the eighth of a series of annual reports that are designed to carry forward the comparative balance sheet of agriculture since 1940.

GREENE, R. E. L., JOHNSON, J. M., and BARNES, R. C. GRADE QUALITIES OF POTATOES IN SELECTED RETAIL STORES IN PITTSBURGH, PENNSYLVANIA, 1950. Fla. Agr. Expt. Sta. Bul. 24, 79 pp., illus. June 1952. (RMA; BAE and BPISAE cooperating.)

This study differs from similar studies in that it was run in a small number of stores during 20 weeks, with each store visited twice each week. Percentages of grade defects varied by source of origin. Potatoes from Florida had the lowest and those from North Carolina the highest percentages.

HARSTON, CLIVE R., and VOORHIES, EDWIN C. TRADE IN WESTERN LIVESTOCK AT AUCTIONS. 2. ANALYSIS OF LIVESTOCK MARKETINGS. Wash. Agr. Expt. Sta. Bul. 537, 112 pp., illus. June 1952. (RMA; Agr. Expt. Stas. of the Western States and USDA cooperating.) (A Western Regional publication.)

The livestock auction market in the West serves as a market point for all grades and classes of livestock, although cattle represent more than 90 percent of the total value of livestock sold. Approximately 72 percent of all livestock consigned to Western auctions were sold by weight.

HOWELL, L. D. MARKETING AND MANUFACTURING SERVICES AND MARGINS FOR TEXTILES. U. S. Dept. Agr. Tech. Bul. 1062, 294 pp., illus. September 1952. (RMA)

JENNINGS, RALPH D. ECONOMIC CONSIDERATIONS IN USE OF UREA FOR FEEDING BEEF AND DAIRY CATTLE. U. S. Bur. Agr. Econ. F.M. 98, 14 pp., illus. September 1952. (Processed.)

One pound of urea contains as much nitrogen as 6.4 pounds of average cottonseed or soybean meal; therefore one pound of urea will replace the nitrogen in 6 to 7 pounds of oil meal. But urea contains no feed energy and a quantity of grain equal in energy to the oil meal replaced must be fed with it.

JENNINGS, RALPH D. A LOOK AT THE PROTEIN SITUATION FOR LIVESTOCK. U. S. Bur. Agr. Econ. F.M. 97, 15 pp. September 1952. (Processed.)

Brings to date two processed reports of the Bureau—"The Deficit in Protein for Livestock," issued in April 1946, and "A Look at the Protein Situation for Livestock," issued in March 1950. To increase the protein content of the feed supply: (1) Increase acreage and yield of good hay and pasture; (2) plant larger acreages of soybeans and other oilseeds; (3) expand use of urea; (4) use more Vitamin B_{12} and antibiotics in hog rations; and (5) produce one or more amino acids by chemical means.

NORTH CENTRAL LIVESTOCK MARKETING RESEARCH COMMITTEE. MARKETING FEEDER CATTLE AND SHEEP IN THE NORTH CENTRAL REGION. Nebr. Agr. Expt. Sta. Bul. 410, 69 pp., illus. May 1952. (Agr. Expt. Stas. of Ill., Ind., Ia., Kans., Ky., Mich., Minn., Mo., N. Dak., Ohio, S. Dak., and Wis. and USDA cooperating.) (North Central Regional Pub. 25.)

Includes case studies of rail shipments of feeder livestock, special studies involving the factors that affect the feeding industry, and factors that influence the extent of feeding. A 30-page combined supplement details the methodology and procedure used.

NYBROTEN, NORMAN. MARKETING EGGS IN RETAIL STORES OF THE NORTHEAST, 1949. W. Va. Agr. Expt. Sta. Bul. 353, 39 pp., illus. June 1952. (RMA; Agr. Expt. Stas. of Conn., Del.; Maine; Md.; Mass., N. Y., Pa., R.I., and W. Va.; PMA; BAE; and FCA cooperating.)

Reports the merchandising practices in marketing eggs in retail stores, describes them, and when feasible relates them to egg quality and egg sales.

OLSON, RUSSELL O., and HEADY, EARL O. ECONOMIC USE OF FORAGES IN LIVESTOCK PRODUCTION ON CORN BELT FARMS. U. S. Dept. Agr. Cir. 905, 44 pp., illus. 1952. (Iowa Agr. Expt. Sta. cooperating.)

In addition to their direct value as livestock feed, grasses and legumes may contribute indirectly to farm income by increasing or maintaining yields of other crops. The most profitable forage-utilization system for an individual farmer is determined by three basic relationships: (1) Rate at which forage substitutes for grain in the livestock ration and in the crop rotation; (2) capital and labor requirements; and (3) risk and uncertainty.

ROWE, GORDON A. CHANGES IN MILK UTILIZATION (PORTLAND MILKSHED, 1940-50) Oreg. Agr. Expt. Sta. Cir. of Inform. 512, 12 pp., illus. June 1952.

Dairy manufacturing plants located in the Portland, Oreg., milkshed are largely residual claimants to milk left over after the requirements of the fresh milk market are satisfied. Condenseries, powder, butter, and cheese plants in the area have changed their operations to meet adjustments in available supplies of local milk. This has meant greater concentration on the output of ice cream and powder and a lower output of butter and cheese.

SAMMET, L. L. EFFICIENCY IN FRUIT MARKETING. ORCHARD-TO-PLANT TRANSPORTATION. Calif. Agr. Expt. Sta., Giannini Found. Agr. Econ. Mimeogr. Rept. 131, 29 pp., illus. July 1952. (RMA; BAE cooperating.)

Differences in labor requirements are related to observed differences in method and equipment.

SLUSHER, M. W., and MULLINS, TROY. RICE MILL YIELD AND GRADE IN RELATION TO VARIETY AND METHOD OF HARVEST. Ark. Agr. Expt. Sta. Bul. 526, 36 pp., illus. June 1952. (BAE cooperating.)

Findings indicate need for continued and expanded research to discover means of solving problems facing producers and handlers of rice.

STEVENS, I. M., BURDICK, R. T., MASON, H. G., and GAZAWAY, H. P. MARKETING WESTERN FEEDER CATTLE. A western regional research publication. By a technical committee representing the agricultural experiment stations of eleven western States in cooperation with the Bureau of Agricultural Economics. Wyo. Agr. Expt. Sta. Bul. 317, 92 pp., illus. June 1952. (RMA)

Describes the place of the cattle industry in the western economy and furnishes cattle producers and marketing agencies with some of the basic information they will need to improve marketing practices, particularly with respect to the marketing of range cattle.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. AGRICULTURAL OUTLOOK CHARTS, 1953. 76 pp. Washington, D. C. October 1952.

Includes charts showing prices and incomes, markets and marketing, livestock and meat, feed grains, wheat, dairy products, poultry products, fats and oils, cotton and wool, tobacco, and fruits and vegetables. Charts showing our changing agriculture in addition to those showing important elements in the intermediate outlook may also be found here.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. CROP PRODUCTION PRACTICES. LABOR, POWER, AND MATERIALS, BY OPERATION—CORN BELT AND LAKE STATES. U. S. Bur. Agr. Econ. F.M. 92, Sec. 2, 234 pp., illus. June 1952.

Includes data for a number of crops in the various type-of-farming areas.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. DISCRIMINATION TESTS AND PRELIMINARY PREFERENCE RATINGS OF FROZEN CONCENTRATES FOR LEMONADE. 20 pp., illus. Bur. Agr. Econ. September 1952. (RMA) Lemon Products Advisory Board cooperating.) (Processed.)

Within the commercially feasible range as presently defined, most people are unable to detect ° Brix and Brix-acid ratio differences in frozen concentrates for lemonade.

UNITED STATES DEPARTMENT OF AGRICULTURE. TECHNOLOGY IN FOOD MARKETING. A SURVEY OF DEVELOPMENTS AND TRENDS IN THE PROCESSING AND DISTRIBUTION OF FARM-PRODUCED FOODS, 1930-50. U. S. Dept. Agr. Agr. Monog. 14, 115 pp., illus. October 1952. (RMA)

A special report prepared under the direction of an Inter-Bureau Committee. Includes chapters on developments in the modern marketing system from 1930-1950, frozen foods for the mass market, technology in commercial processing, technology in transportation, storage, and communications, and technology in retail distribution; chapters on effects of technology on the marketing system, producers, and consumers; and chapters showing developments on the horizon and some of the problems and choices that lie ahead.

UNITED STATES-FAO INTER-AGENCY COMMITTEE. AGRICULTURAL PROGRAMS OF THE UNITED STATES—CURRENT AND PROSPECTIVE. A Report to the Food and Agriculture Organization of the United Nations. Washington, D. C., United States Department of Agriculture. 64 pp., illus. November 1952.

This report deals particularly with the probable situation in agriculture in the United States in the 5 years ahead but gives attention also to the present situation and the longer-range prospects. Chapters on the objectives of agricultural policy, requirements for food and fiber, production potential, and future programs are included.

VOELKER, STANLEY W. LAND-USE ORDINANCES OF SOIL CONSERVATION DISTRICTS IN COLORADO. Colo. Agr. Expt. Sta. Tech. Bul. 45, 55 pp. March 1952. (Great Plains Counc. Pub. 5.)

As Colorado is a testing ground for land-use regulation by local district ordinances, this study of experience with such ordinances was made. The report describes the ordinances and the purposes for which they were adopted; analyzes the administrative experience of selected districts to learn reasons for success or failure of ordinances; and presents suggestions regarding adoption and administration of land-use regulations.

WILT, H. S. and HOGLUND, C. R. REDUCING DAIRY FEED COSTS. Mich. Agr. Expt. Sta. Spec. Bul. 383, 19 pp., illus. October 1952. (RMA)

Study of the liberal use of high-quality roughage on six south central Michigan farms indicates that a greater use of such roughage in the dairy ration could result in a saving of several million dollars annually in the feed bill of Michigan's dairy cow herd of nearly a million head.

☆ U. S GOVERNMENT PRINTING OFFICE: 1953—202562

AGRICULTURAL ECONOMICS
RESEARCH

Is published quarterly by the Bureau of Agricultural Economics, U. S. Department of Agriculture. The printing of this publication was approved by the Director of the Bureau of the Budget, June 5, 1952.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 20 cents a single copy, 75 cents a year, domestic, $1 foreign.